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ABSTRACT

An evaluation was conducted of student use of the PLATO computer assisted instruction system in the Highland Park Independent School District, Amarillo, Texas, a school district that has one elementary school, one middle school, and one high school. The evaluation was based on telephone interviews with the Assistant Superintendent, three written surveys from district teachers, and three from district students. All students in grades 3 through 12, including special education students, a population of about 860 students, use PLATO. The district standard is 2 hours use a week, evenly divided among mathematics, language arts, and science and social studies. In the 1999 and 2000 school years, students mastered an average of 48 PLATO modules a year, spending an average of 18 hours in PLATO learning per year. The level of PLATO use was higher in 1999 than in 2000, with 50 modules mastered that year. Highland Park students' mathematics and reading scores on the Texas Learning Index (TLI) were somewhat higher than the statewide averages on the tests of the TLI, and the district's writing scores were somewhat lower than state averages. The analysis of PLATO use data found that increases in the number of PLATO modules mastered are positively related to higher test scores. The more PLATO modules students mastered, the higher their TLI scores. The study also found that taking more hours on PLATO without making progress in mastering modules is negatively related to higher test scores. This suggests that slow progress mastering modules on PLATO can be used as an indicator of learning problems teachers should note and address. (Contains 16 figures.) (SLD)

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Evaluation Series

Highland Park ISD, Amarillo, Texas

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Evaluation Prepared by:

David W. Quinn, Ed. D.
Nancy W. Quinn, M. S.

Series Editor:

Rob Foshay, Ph. D.
Vice President,
Instructional Design and Cognitive Learning
rfoshay@plato.com

PLATO Learning, Inc.
10801 Nesbitt Avenue South
Bloomington, MN 55437
USA
http://www.plato.com

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Executive Summary

This study is an examination of student use of the PLATO system in Highland Park Independent School District (Highland Park ISD). This district is located in the center of Amarillo, Texas, and includes one elementary school, one middle school, and one high school. The total student population numbers approximately 860. The following description of the PLATO program is based upon phone interviews with the Assistant Superintendent who serves as Site Coordinator, three written surveys from district teachers, and three surveys from district students. The data on PLATO use come from system files; standardized test scores come from the Texas student assessment system.

Program Description. PLATO was brought to Highland Park District by their new Superintendent; its use is monitored by the Assistant Superintendent/Site Coordinator. The program has been used by high school students for four years and middle and elementary students for two years. Student scores on the Texas achievement test are monitored by the district, as are the teacher PLATO reports that are required every six weeks. Principals oversee PLATO use at the building level. The district has provided teacher training and PLATO support.

All students in grades 3 through 12, including special education students, use PLATO. The district standard for student PLATO use is two hours per week, evenly divided between math, language arts, and science and social studies. Teachers are expected to assign students to PLATO modules based upon their performance on state and local tests and learning objectives. Instructors are also expected to correlate PLATO assignments with classroom instruction and to monitor student progress. The building administrators monitor PLATO use in their schools.

Data Analysis. Student use of PLATO is presented in this report as time spent on the system and the number of modules mastered. As currently available, student data is aggregated for all three schools.

For the 1999 and 2000 school years students mastered an average of 48 PLATO modules per year; they spent an average of 18 hours engaged in PLATO learning per year. The level of PLATO use was significantly higher in 1999 than 2000: 50 modules mastered in 1999 compared to 28 in 2000; 20 ½ engaged hours in 1999 compared to 7 ½ hours in 2000.

The Texas Assessment of Academic Skills (TAAS) is a criterion-referenced measure of student achievement in the statewide curriculum for mathematics, reading, and writing. The TAAS scores are reported using the Texas Learning Index (TLI). The TLI provides a standardized achievement score which facilitates comparisons of scores across grades or over time. The TLI were used to report student achievement in math, reading, and writing in Highland Park.

The Highland Park math and reading scores were somewhat higher than the statewide averages on these tests; the district's writing scores were somewhat lower than state averages.

The analysis of PLATO use data found that increases in the number of PLATO modules mastered are positively related to higher test scores. The more PLATO modules students mastered, the higher were their TLI scores.

The study also found that taking more hours on PLATO without making progress in mastering modules is negatively related to higher test scores. This suggests that slow progress in mastering modules on PLATO can be used as an indicator of learning problems that teachers should note and address.

Table of Contents

Executive Summary 2

Introduction 5

Program Description 5
- The District. 5
- Technology in the District. 6
- Support of PLATO. 6
- Teacher Preparation. 6
- Program Design. 7
- Student Placement in PLATO. 7
- Student Computer Use. 7
- Monitoring Student Achievement. 8
- Learning Materials. 9
- Teacher PLATO Improvements. 9
- PLATO Improvements. 9
- Teacher and Student Agreement. 9

Data Analysis 11

PLATO Use and Test Score Findings. 11
- Sample. 11
- PLATO Use Data. 11
- Texas Learning Index (TLI). 12
- Differences between 1999 and 2000 Use and Test Data. 15
- Relating PLATO Use to Test Scores. 17

Instructor's PLATO Evaluation 21
- PLATO Content. 21
- Teacher Experience with PLATO. 24
- Student Experience with PLATO. 25
- Frequency of Activities. 26

Conclusions & Discussion 27

About the Authors 29

Highland Park Independent School District

Introduction

Highland Park ISD has adopted the PLATO system as part of a strategy to improve individual student learning and to raise their scores on the Texas state assessment tests in mathematics, reading, and writing. This is a study of PLATO as part of the regular school instruction in upper elementary, middle, and high school classes. Special attention is given to the use and impact of PLATO on mathematics, reading, and writing performance during the 1998-1999 (1999) and 1999-2000 (2000) school years.

The following report first describes Highland Park—the process they used in implementing PLATO, the support they have provided for PLATO, and teacher preparation for technology. This report describes the use of PLATO in school in terms of program design, student placement in PLATO, student computer use, and the monitoring of student computer use. The program descriptions were taken from these sources:

Phone Interview with Program Coordinator—Site Profile Interview Questions (1)
Written responses—PLATO Instructor Interview Questions (3)
Written responses—Instructor's PLATO Evaluation (3)
Written responses—PLATO Learner's Survey (3)

Secondly in this report, the "Data" section describes the various evaluation activities and their results from the following sources:

Student Use Data and Outcome Findings (806)
Instructor's PLATO Surveys and Interviews (3)

Thirdly, the Conclusions section discusses the findings and relates them whenever possible to the overall picture of this PLATO application.

Program Description

The District. Highland Park district is located in the panhandle area of Texas where the southern plains meet the western desert. Highland Park ISD is a relatively small school district, serving a community in the city of Amarillo, Texas. The U.S. Department of Education describes Highland Park as being located within a mid-size city.

The district has one high school, middle school, and elementary school. It employs 65 teachers and enrolls 862 students. The average teacher-student ratio is 1 to 13. For the 2000 school year, high school enrollment was 204, middle school enrollment was 215, and elementary enrollment was 443 students. The majority of students are white (72%); Hispanic students comprise 23% of the student body. Three percent or less of the school populations is Black, Asian, or American Indian/Alaskan. As an indicator of community

economic status, 51% of elementary students in the district qualify for free or reduced price lunch.

The Assistant Superintendent and PLATO site coordinator, Jamie Carol, was interviewed following the Site Profile Interview Questions. Ms. Carol arranged for instructors to complete in writing the instructor's survey, and the instructor's interview questions as well. Her choices were three teachers, one from each school. The teachers, in turn, selected one student in each of their classes to complete the Learner's Survey; two of the three students were not designated as to gender, so for this report they are referred to as males. The following program information is derived from these interviews and teacher and student surveys.

Technology in the District. Highland Park has been using the PLATO program in the high school for the last four years and at the middle and elementary[1] levels for two years. At the elementary level, they have been using the Jostens programs for the past seven years. The choice of PLATO was a district decision based on desires to achieve high educational goals in their district. Ms. Carol said, "We believe that differentiated instruction leads to higher student learning. Our strategy is to increase the TAAS score by meeting individual student needs."

Ms. Carol continued: "Our district superintendent had experience with the PLATO system in his prior assignments. When he became our superintendent he suggested that we would adopt the PLATO system. He also suggested the PLATO curricula to use."

Support of PLATO. The technology department in the district takes care of all of technical support for the PLATO system. The district has two full-time technology specialists to support PLATO. In addition, at the schools ten staff members have been assigned to support teachers. The school-level support staff members are each budgeted to provide eight days of support per year.

Teacher Preparation. Generally speaking, district teachers have had four or more years of computer experience. However, due to staff turnover, this does not necessarily increase over time. No specific information was provided about teacher PLATO training. However, this sample of three said that they felt well trained; only one was interested in more.

In this study, the elementary school respondent teaches fifth grade math, science and social studies; she has used computers in education for 12 years and PLATO for four years. The middle school interviewee teaches reading and language to 6th and 8th grade students; she has used computers for four years and PLATO for just one year. The high school respondent teaches social studies and uses PLATO for U.S. History; he has used computers for four years, and PLATO for three.

---

[1] The PLATO products discussed in this report do not include the elementary-level courseware recently added through acquisition of Wasatch Interactive, Inc.—*ed.*

Program Design. Grades three through twelve in Highland Park use PLATO throughout the school year. All students in the grades three through 12 use the PLATO system—both general education and special education students. Across the district, there are approximately 600 PLATO users per year.

The district requires that students spend two hours a week on PLATO or cover 6 to 9 modules in this time period. This time should be distributed approximately as:

- 45 minutes of math
- 45 minutes of language arts
- 45 minutes of science and social studies

There is no maximum time limit on using PLATO other than the constraints of student time and system availability.

The Assistant Superintendent oversees the district use of Plato. She says, "We have staff turn in reports every six weeks on Plato use to encourage their use of the system and keep students moving through the modules." The regular school administrators supervise the teacher use of Plato on an ongoing basis in each school.

Student Placement in PLATO. The district creates its own learning paths using the *PLATO Pathways* management system. District and school personnel look at the state TLI student test scores every year to determine areas of skill or informational strengths and deficiencies. At the beginning of each semester, in September and January, students are assessed for their knowledge on TAAS objectives. In addition, student PLATO computer reports are reviewed every six weeks. Based upon this information, students are assigned by their teachers to modules that address their learning needs, particularly those that are aligned with the TAAS and demonstrated on PLATO reports. Instructors are responsible for assigning students appropriately and for synchronizing PLATO instructional activities with other educational activities. In order to do these things, teachers need to know how to use reports and test data and how to use the PLATO management system.

Student Computer Use. The Assistant Superintendent feels that the students generally know the mechanics of a how to use the PLATO system; however, some teacher responses indicate that some students do have some difficulty.

Students use PLATO as part of their regular classroom learning experience, with their regular classroom teachers overseeing their PLATO work. Most students work alone, one-on-one with the system. Ms. Carol says that some of their geometry classes are starting to use the system in whole group instruction, to pre-teach students on concepts in the PLATO curriculum and to clarify points that students have had trouble with in the past. The high school social studies teacher said that he sometimes uses group work.

Learners who fail a mastery test are required to study the corresponding tutorial before re-taking the mastery test. No other comments were written about monitoring student completion of lesson parts.

Learners are allowed to "place out of" a module by taking the mastery test first, but they cannot test out of the TAAS objectives. Testing out is a fairly common practice in language arts and math; it is not so common in science and social studies. Ms. Carol shared the following: "It is really an ongoing effort to make sure that the staff understands that it is okay to accelerate students through the curriculum. However, our staff needs more training to implement the strategy." This sentiment was echoed by one of the teachers.

According to one teacher interview form and the corresponding student survey, it seems that students in that class are held to the same learning pathways, and students cannot proceed, even though they have mastered the material. This situation has created dissatisfaction for the student, since he feels that he knows the material and has gained little from his PLATO work, at least in math, writing, and science. From the teacher's point of view, she tries to match the PLATO objectives with the areas in which students have had low test scores. Her survey indicates that she feels she is able to make appropriate assignments, although the twice-changed answer indicates that she needed to think about it. In a later question, she confided: "PLATO serves a great purpose for reinforcement, practice, and tutorials for older students. It's difficult to find the proper level of study for intermediate age kids in an elementary school (3-5)."[2]

None of the three teachers who were interviewed said that they used PLATO for an introduction to a new lesson or unit or for placement or assessment of students. The high school teacher uses the program during the activity or information phase of a lesson. All three respondents say that they use it for practice, review, reinforcement or transfer (application) phase. In another response, however, one teacher wrote that the classroom rotation actually made PLATO time more of an assessment. The elementary teacher, in her three subject areas, specified that she used it for reinforcement. The middle and high school teachers reported that PLATO was available any time as a resource, but they did not include details.

Monitoring Student Achievement. The district monitors student progress on PLATO by requiring reports every six weeks. On the survey, all three teachers wrote that they use PLATO reports to monitor student work. In addition, the elementary teacher monitors students by observing them on the computer somewhat and using time-on-task reports, however, most of her time is spent with other students during "Center time" or reading the Weekly Reader to them. The high school teacher monitors students while they work, answering questions and problems and asking what they have learned. The middle school teacher usually works with other students during computer time.

In order to encourage consistent student work, one teacher observed student computer work and two gave grades for PLATO work. The middle school teacher gave grades for the scores and number of modules completed. The high school teacher gave the PLATO average the weight of a major test grade.

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[2] The recently-added PLATO Primary curricula, not discussed in this report, are age-appropriate for 3-8. – *ed.*

Learning Materials. All of the teachers who were surveyed use textbooks and Web sites along with PLATO. None of them uses PLATO paper products.

Teacher PLATO Improvements. One teacher suggested on the open-ended item that she could improve her use of PLATO by assigning it in smaller units so that she could display student work more clearly. Indeed, reports on smaller units could help her to adjust her classroom instruction as well as monitor student success. She also wrote that she should tie PLATO more to the lesson in class. The middle school teacher said that perhaps she could give more description of the PLATO lesson.

PLATO Improvements. Overall, these teachers like most the reinforcement and review of concepts they have taught in their classrooms. They had separate major dislikes of the program. The elementary teacher said that students did not know how to answer questions and that they did not like working on the program.[3] The middle school teacher said that lack of time was her biggest problem. The high school teacher feels that there is not enough information on government and economics for his needs. In addition, the teachers made the following suggestions:

Elementary Teacher--Make them more age-appropriate, with more animation and color for elementary students. Make directions easier to understand [for students]…It is difficult to find the proper level of study for intermediate age kids in an elementary school (3-5).

Middle School Teacher—More consistency in the scoring system.

High School Teacher— More modules for government and economics. Make the world view section part of reports. [PLATO] seems to work for most students.

Teacher and Student Agreement. In one instance of elementary school, the teacher and student agree that the PLATO instruction is not closely aligned with classroom instruction. The teacher reports that students do not generally understand the explanations, but that the program does involve students. A student from her class provides a contrasting point of view by saying he knows the information and feels there is not enough involvement. He reports trying hard to learn from the computer, but he thinks the lessons are not interesting and would not recommend the program to others. He does not want to do more [at least under the current situation.] His problem is definitely not the result of problems with the computer in general; he says he feels comfortable

[3] The PLATO courseware reviewed here includes content taught at grade levels 3-14. However, this courseware is designed for adults and young adults, and use below upper elementary or middle school generally is not recommended by PLATO Learning, Inc.. The PLATO Primary courseware, which has been recently added, is age-appropriate for lower elementary. However, it is not a subject of this report.—*ed.*

using computers and that they do not affect his self-esteem. The teacher believes that students do not receive PLATO well, and this student confirms her opinion.[4]

The middle school instructor was upbeat in her responses and positive about the program and the student experience with it. She feels pressed for time, and says she should give more introductions to PLATO modules. However, with the rotations on PLATO, it seems more like an assessment than a true learning experience for students. The student surveyed in her class reports feeling comfortable in using the computer. She is likewise positive in his responses and says she tries hard and that the experience makes her feel confident. Fun in using the computer appears to be her primary motivation and wrote that sometimes the lessons are "boring", especially in science. She has learned a lot from PLATO in all subjects but social studies, about which she was moderately positive in her opinion.

The high school U. S. History teacher is positive about PLATO, although he would like more depth in the modules and assessments and more social studies content. He is "neutral" about whether students respond well to PLATO (which could indicate a mixture of opinions, depending upon lesson content and students' abilities/interests/personalities). His student says he can get into the program and understands what it teaches, but that he cannot stop and start when he wants to; neither can he get help when he needs it. He feels that he is learning what he needs to but that PLATO does not necessarily match classroom instruction. He reports that he does not try hard and, indeed, many of his responses are "neutral". He feels most strongly about being able to go back in lessons to review and does not like it when he cannot. He would also like fewer questions at the ends of lessons, probably indicating that he does not understand the role of assessment in learning or that the teacher is not using assessment as an instructional support. He learned least from math, some from reading and writing, and more from social studies and science.

[4] This reaction is often indicative of inappropriate placement or alignment decisions, so students are compelled to work on modules which are not appropriate to their level. Since the secondary-level courseware was used here at the primary level, it is an expected finding.—*ed.*

Data Analysis

PLATO Use and Test Score Findings

Sample. The Highland Park dataset included student records from the 1999 and 2000 school years. Records for a total of 806 students were available for the evaluation. Of these students, 471 had complete or partial data for both years and 334 had complete or partial data for one of the two years. Data from both groups were included in the analysis as appropriate.

PLATO Use Data. The Highland Park computer network collected PLATO use data for all participating students. The PLATO system data included:

- Number of PLATO modules mastered
- Total hours of PLATO activity engaged time

This data does not include modules, if any, that students may have studied in years earlier than 1998-1999 or 1999-2000 reports. Nor does it assure that modules studied were necessarily related to the test scores available.

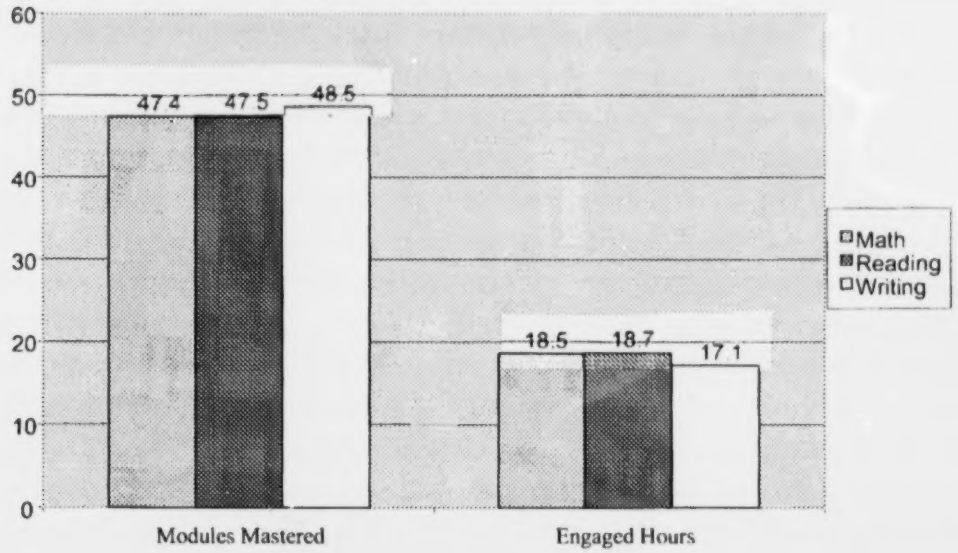
In the analysis a student's record was used only if it had both PLATO use data and test scores within a given year. Since some students did not have complete records on use or test scores, different subsets of students were used for each type of test: math, reading, and writing. While the students in each group were very similar on their level of PLATO use, the analysis described PLATO use separately for the subsets of each test.

The average number of modules mastered per year by the students studied was 48 (math 47, reading 48, and writing 49). The number of modules mastered ranged from a low of zero to a high of 493 modules. The average number of engaged hours using PLATO was about 18 hours (math 19 hours, reading 19 hours, and writing 17 hours). Hours engaged in PLATO ranged from near zero hours to 155 hours—equivalent to one person month of full-time use. Table 1 gives descriptive statistics for PLATO use; Figure 1 shows the average use by test subgroups

Table 1. Student PLATO Use by Test Groups for Both Years

Variables		Modules Mastered With			Engaged Hours With		
		Math Scores	Reading Scores	Writing Scores	Math Scores	Reading Scores	Writing Scores
Number of Cases	Valid	725	726	541	725	726	541
	Missing	81	80	265	81	80	265
Mean		47.4	47.5	48.5	18.5	18.7	17.1
Std. Deviation		58.7	59.2	63.8	20.8	21.5	21.9
Minimum		0	0	0	0.02	0.02	0.02
Maximum		493	493	493	132.2	137.1	155.4
Percentiles	10%	4	4	2	1.8	1.8	1.5
	25%	12	12	8	4.8	4.9	3.7
	50%	27	27	26	10.8	10.8	8.9
	75%	61	61	65	24.5	24.5	21.7
	90%	111.2	110.4	122	47.0	47.0	42.2

Figure 1. Average PLATO Use Measures for Subgroups by Test Scores



Texas Assessment of Academic Skills (TAAS). The Texas Assessment of Academic Skills (TAAS) is the state's criterion-referenced test for measuring learning outcomes; it is part of the accountability system. TAAS measures the statewide curriculum in reading and mathematics at grades 3 through 8 and the exit level; in writing at grades 4, 8, and the exit level; and in science and social studies at grade 8. Spanish-version TAAS tests are administered at grades 3 through 6. Satisfactory performance on the TAAS exit level tests is prerequisite to a high school diploma. In Highland Park, students were given the TAAS for math and reading every year from 3rd through 8th grade and 10th grade. Writing TLI scores are available for grades 4, 8, and 10.

Texas Learning Index (TLI). Developed for use with the TAAS, the Texas Learning Index (TLI) is a way of interpreting math and reading test results. This state-developed statistical index (a scale score) makes it easy to compare student TAAS scores. The student outcome measures used in this evaluation were taken from the TAAS results and TLI comparisons in math, reading, and writing. A TLI score of 70 on the math and reading corresponds to the passing standard, the minimum expectation level, at each grade level. A writing TLI of 1,500 is the passing standard.

Highland Park math scores are somewhat higher than the state's average year 2000 math scores; the median Highland Park score is higher than that of approximately two-thirds (62%) of other Texas schools. Highland Park reading scores are about the same as the general Texas reading scores. The Highland Park median is above 57% of state reading scores. On the other hand, Highland Park writing scores are somewhat lower than the

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Texas writing scores; Highland Park median writing score was above only 37% of state writing scores.

Table 2. Highland Park Student Test Scores for Both Years

Variables		Test Scores		
		Math TLI Score	Reading TLI Score	Writing Score
Number of Cases	Valid	445	446	221
	Missing	361	360	585
Mean		83.7	86.8	1667.2
Std. Deviation		6.8	9.5	230.4
Minimum		53	47	640
Maximum		93	101	2490
Percentiles	10%	75	73	1500
	25%	80	83	1550
	50%	86	89	1630
	75%	89	94	1760
	90%	91	97	1836

The following figure—a "box plot"—demonstrates the range of the majority of test scores for both Highland Park and the state of Texas. The numbers in the boxes show the scores attained by the middle 50% of the students. The line that extends downward out of the boxes ("whiskers") end at the point below which 10% of the students scored; the lines extending upward end at the point below which 90% of students scored. For example, the first gold colored box shows the distribution of Highland Park math scores. The middle half of the scores were between 80 and 89 points. Ten percent of the students scored below 75 points; ten percent also scored above 91 points. The minimum passing level, 70 points, is marked with a red line.

Figure 2. Highland Park and Texas State Math and Reading TLI Scores

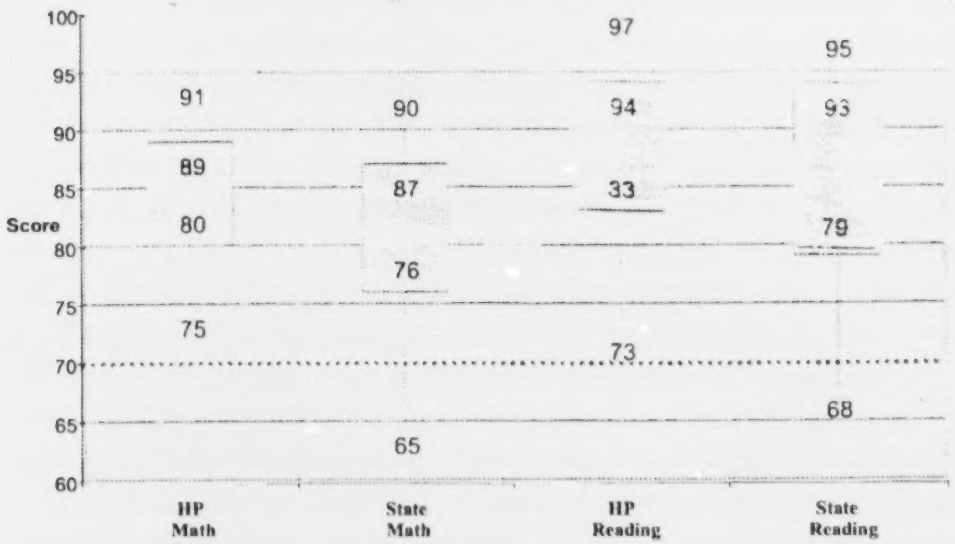
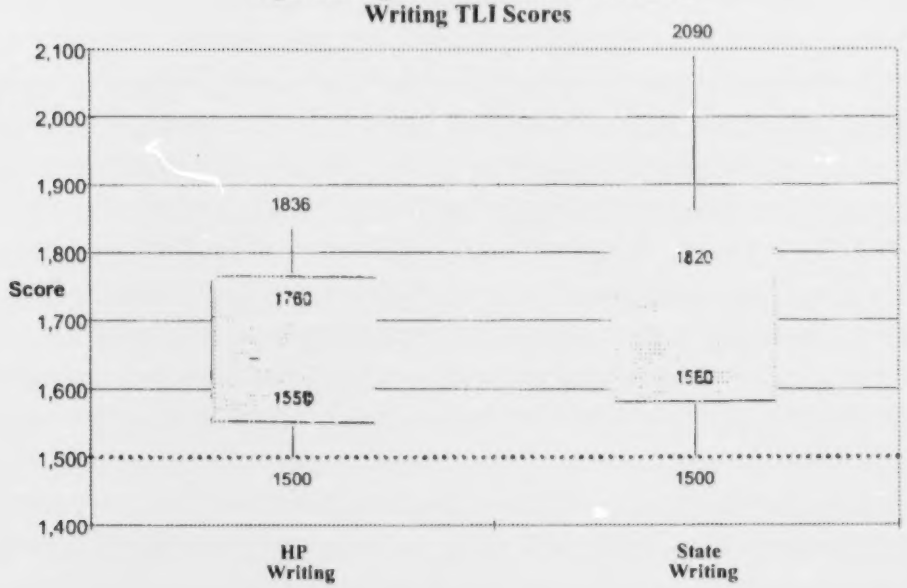


Figure 3. Highland Park and Texas State Writing TLI Scores



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Differences between 1999 and 2000 Use and Test Data. Having evaluation data for two school years allows us to ask whether there have been changes in the level of PLATO use or in student outcomes from year to year. Interviews with district personnel indicated that the level of PLATO use had changed from 1999 to 2000, and that there was a question of whether this might have affected student outcomes.

Whole-group comparisons. A comparison of 1999 data with the 2000 data showed that there was a significant difference in PLATO use between the two years. In 1999 there were significantly more modules mastered and more hours of students engaged in PLATO learning. These differences were relatively large, equaling about a one-half standard deviation change. For the 1999 and 2000 school years students mastered an average of 48 PLATO modules per year; they spent an average of 18 hours engaged in PLATO learning per year. The level of PLATO use was significantly higher in 1999 than 2000: 50 modules mastered in 1999 compared to 28 in 2000; 20 ½ engaged hours in 1999 compared to 7 ½ hours in 2000.

On the other hand, a comparison of TLI math, reading, and writing scores for all students in 1999 compared to 2000 showed no significant difference in test scores between the two years. All differences were within the limits expected for simply random variation in scores from year to year.

Table 3. Comparison of Use and TLI Scores for 1999 and 2000 School Years

Variable	Year	N	Mean	Std. Deviation	*t*	df	Sig. (2-tailed)
Modules Mastered	1999	674	39.49	49.97	7.93[a]	1082.52	0.000
	2000	602	21.72	28.13			
Hours Engaged	1999	674	15.63	20.27	8.91[a]	858.85	0.000
	2000	602	8.20	7.23			
Math Score	1999	277	83.20	7.53	-1.60[a]	527.07	0.111
	2000	353	84.09	6.15			
Reading Score	1999	281	86.65	9.64	-0.99[b]	631	0.320
	2000	352	87.39	8.89			
Writing Score	1999	84	1635.94	155.82	-1.78[a]	218.70	0.076
	2000	137	1686.41	264.66			

[a] Equal variances not assumed for *t*-test
[b] Equal variances assumed for *t*-test

Matched-group comparisons. A different look can be taken at the issue of year-to-year change by looking only at students who have test scores in both 1999 and 2000. This matched-group approach is usually more sensitive to small differences than just looking at whole-group comparisons. However, the findings do not change very much with this analysis approach. There were similarly higher levels of PLATO use in 1999 as compared to 2000; if anything, the engaged time difference was even larger (.75 standard deviations) than it was for the whole-group comparison.

On the TLI scores, the matched-group analysis shows a small increase (.23 standard deviation) in math scores from 1999 to 2000. This difference may be due to many factors such as testing differences or differences in instruction. Reading scores did not change significantly between the two years. For any given student, TLI writing scores were only available for one of the two years so no matched-group writing comparison was possible.

Table 4. Matched-Group Comparisons across 1999 - 2000

Paired Samples Statistics		N	Mean	Std. Deviation	Cor-relation	*t*
Modules Mastered	1999	471	43.0	52.5	0.251[a]	7.99[a]
	2000	471	23.2	30.2		
Engaged Hours	1999	471	17.3	21.3	0.350[a]	10.19[a]
	2000	471	7.9	6.5		
Math Score	1999	186	83.7	6.8	0.628[a]	-3.56[a]
	2000	186	85.1	5.5		
Reading Score	1999	188	87.7	8.6	0.653[a]	-1.23
	2000	188	88.4	9.1		

[a] Significant at $p < .001$

Relating PLATO Use to Test Scores. The primary analysis of the outcome evaluation was the comparison of the level of PLATO use and TLI math, reading, and writing scores. The question being examined is how variations in the number of PLATO modules mastered or in hours engaged in PLATO relate to test scores.

A multiple regression approach was used to look at how mastery and time related to test scores. After doing a preliminary analysis of scatterplots and residual scores, it was decided to look at several independent variables in the regression model:

M	Total number of PLATO modules mastered
M^2	Squared number of modules mastered
H	Total engaged hours for all PLATO use
H^2	Squared number of engaged hours
M * H	Interaction of modules and hours (product of M times H)

The following regression model was then run for each of the three TLI test scores:

$$\text{Predicted test score} = \text{Constant} + M + H + M^2 + H^2 + M * H$$

Finally, reduced regression models were computed by keeping only the independent variables that made a statistically significant contribution to predicting the test scores.

The general finding of the regression analysis is that increases in number of PLATO modules mastered is positively related to higher test scores. The more PLATO modules mastered the higher the TLI scores.

The second general finding of the analysis is that greater numbers of engaged hours on PLATO are negatively related to higher test scores. The more hours spent on PLATO, particularly when the number of modules is controlled for, the lower the TLI score. This suggests that slow progress in mastering modules on PLATO is an indicator of learning problems that the teacher should note and address.

As with other analyses predicting student test scores with a few programmatic variables, this analysis accounted for only a modest portion of the variability in test scores. The math regression model predicts 11 percent of the variability in TLI math scores. The reading regression model predicts 6 percent of the variability in TLI reading scores. The writing regression model predicts 21 percent of the variability in TLI writing scores.

As an aside, the math test, and to lesser degrees the reading and writing tests, showed "ceiling" and "floor" effects. Given that the tests were designed to measure adequate academic progress around a "passing" score, and not to diagnose the full range of student ability, this is not a problem for the state's use of the test. However, one consequence of topping or bottoming out on test scores for the evaluation is that a graph of the relationship between test scores and PLATO use measures shows some leveling off at

high or low levels. This does not necessarily mean that low or high ability students are not benefiting from PLATO instruction; it more likely means that the test is not capable of measuring the effects of instruction outside of a restricted ability range.

The following tables present the reduced regression models for math, reading, and writing TLI scores in Highland Park. The following figures show the predicted response surfaces relating the two PLATO use variables to test outcomes. Predicted test scores are determined by identifying the point on the colored surface directly above the point where the PLATO use variables intersect. The regression formula is more convenient for calculating particular predicted scores; the response surface graph provides an overall picture of the relationship between the variables.

Table 5. Multiple Regression Model for Predicting Math TLI Scores from PLATO Use

Dependent Variable	Model Elements	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	*t*	Sig.
Math TLI Score $R^2 = .114$	(Constant)	83.18	0.62		134.4	0.000
	PLATO Modules Mastered	0.06	0.01	0.60	4.7	0.000
	Engaged Hours	-0.14	0.03	-0.48	-5.2	0.000
	M^2	0.00	0.00	-0.38	-3.1	0.002
	M * H	0.00	0.00	0.31	2.7	0.008

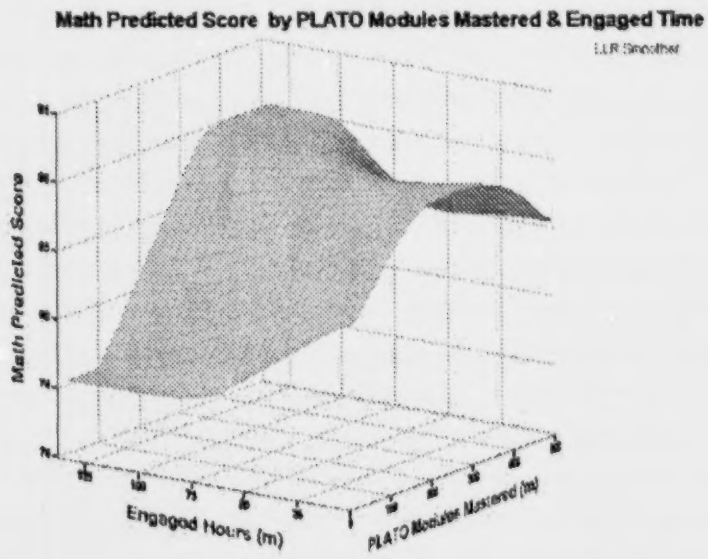
Math Predicted Score by PLATO Modules Mastered & Engaged Time
Math Predicted Score
Engaged Hours (m)
PLATO Modules Mastered (m)

Figure 4.

Table 6. Multiple Regression Model for Predicting Reading TLI Scores from PLATO Use

Dependent Variable	Model Elements	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	*t*	Sig.
Reading TLI Score $R^2 = .055$	(Constant)	84.71	0.78		108.3	0.000
	PLATO Modules Mastered	0.07	0.02	0.49	3.8	0.000
	Engaged Hours	-0.06	0.02	-0.15	-2.6	0.011
	M^2	0.00	0.00	-0.23	-2.0	0.047

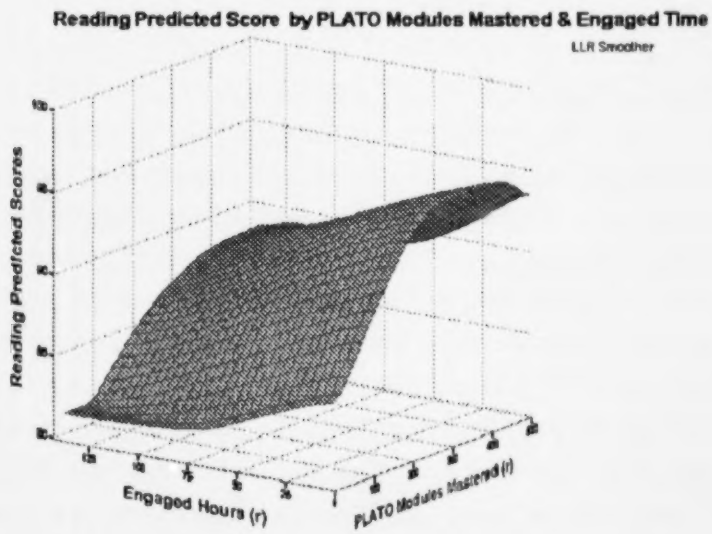
Reading Predicted Score by PLATO Modules Mastered & Engaged Time
LLR Smoother
Reading Predicted Scores
Engaged Hours (r)
PLATO Modules Mastered (r)

Figure 5.

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Table 7. Multiple Regression Model for Predicting Writing TLI Scores from PLATO Use

Dependent Variable	Model Elements	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
		B	Std. Error	Beta		
Writing Score $R^2 = .207$	(Constant)	1675.93	37.36		44.86	0.000
	PLATO Modules Mastered	3.09	1.09	1.06	2.82	0.005
	Engaged Hours	-10.44	3.15	-1.22	-3.31	0.001
	H^2	0.12	0.06	1.44	2.02	0.045

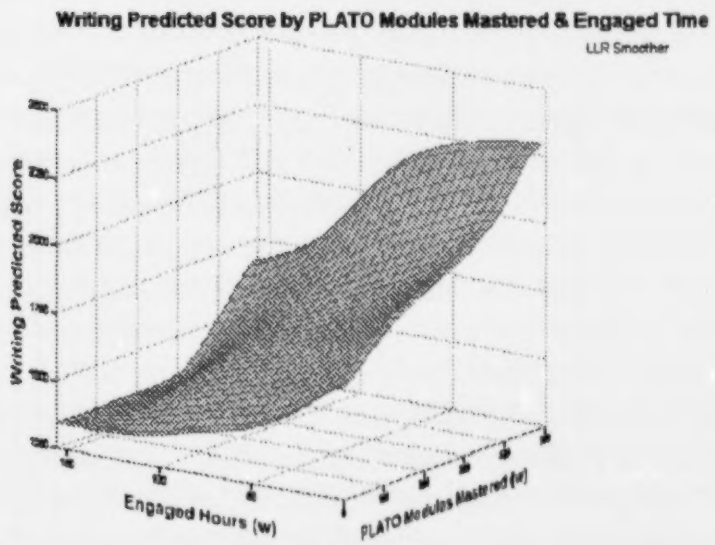
Writing Predicted Score by PLATO Modules Mastered & Engaged Time
LLR Smoother
Writing Predicted Score
Engaged Hours (w)
PLATO Modules Mastered (w)

Figure 6.

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Instructor's PLATO Evaluation

The three teachers who completed the Instructor Interview Questions also completed instructor evaluation survey forms. The survey asked 41 questions about teachers' use of PLATO, divided into three sections. Part I had 28 questions about the PLATO products and their use. Teachers were given a five-point scale of answers, from "Strongly Agree" to "Strongly Disagree." Part II of the survey asked how often teachers gave instructions to students regarding the use of the PLATO system; teachers answered on a six-point rating scale, from 5 (daily) to 0 (never). Part III of the survey posed seven open-ended questions, to be answered in writing.

PLATO Content. The first group of questions discussed here asked about the content of PLATO lessons and their alignment with state, district, and teacher objectives. In response to these questions, from one to three teachers agreed that content was good. Most positive responses came for content being current, course objectives aligning with the teacher's own, and content being good for topics and free of errors.

Figure 7. PLATO Content

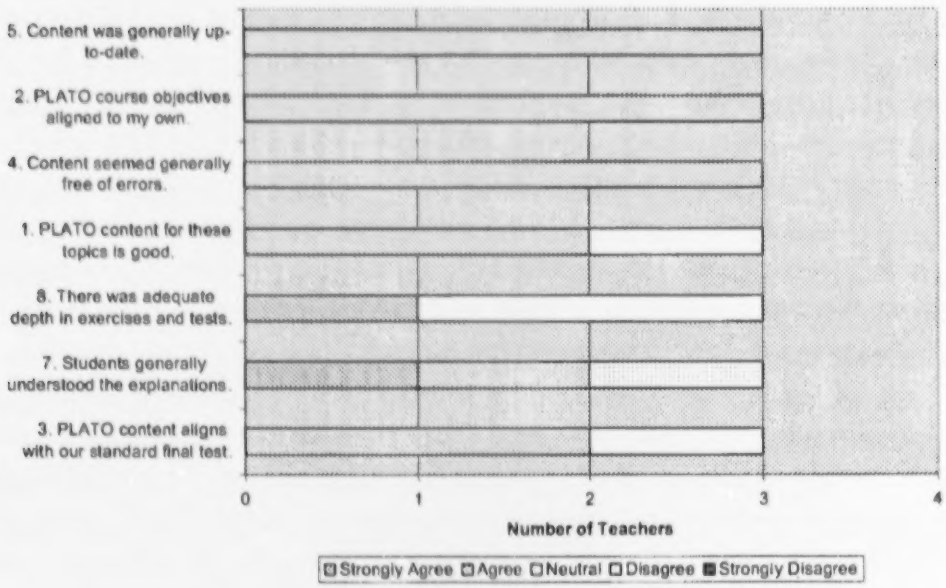
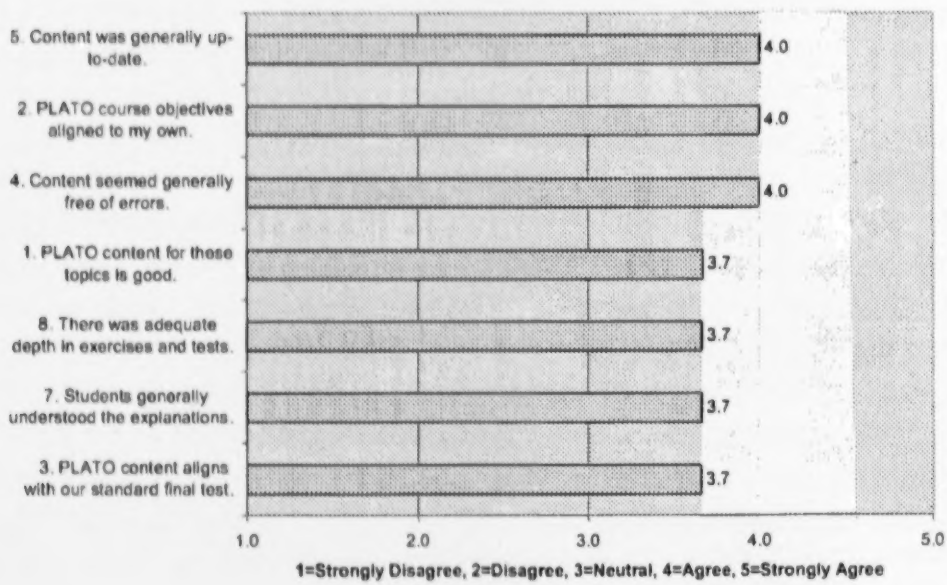


Figure 8. PLATO Content Mean Ratings



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Instructional Design. Respondents were typically positive about PLATO software's instructional design and interface. They were most positive about program tutorials involving students through interactive style and consistent use of keystrokes and display style. Lower ratings were given for graphics or color being used appropriately.

Figure 9. Instructional Design

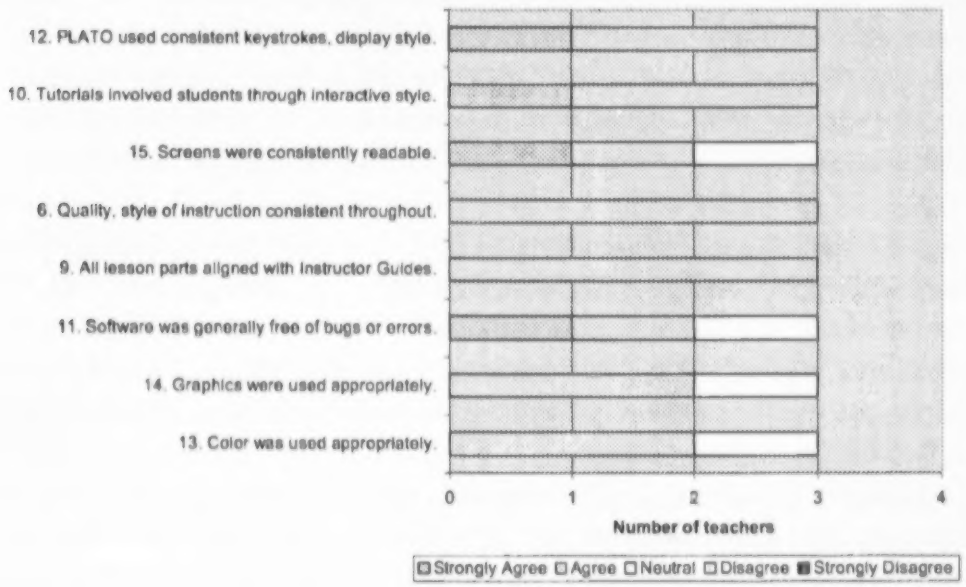
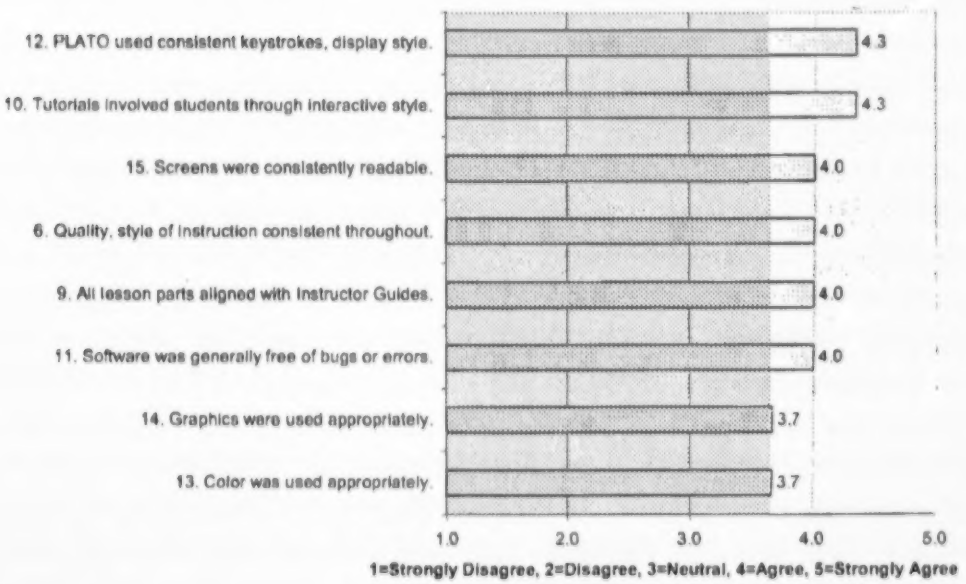


Figure 10. Instructional Design Mean Ratings



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Teacher Experience with PLATO. All of the respondents said that they had been adequately trained to use PLATO. One of the teachers was interested in more training. All of the teachers agreed that they could make assignments on the system. Two teachers agreed that they were able to use student progress reports and to relate PLATO to classroom activities. Two of three teachers said that they enjoy working with PLATO, that PLATO is useful in teaching, and that computer work is productive.

Figure 11. Teacher Experience with PLATO

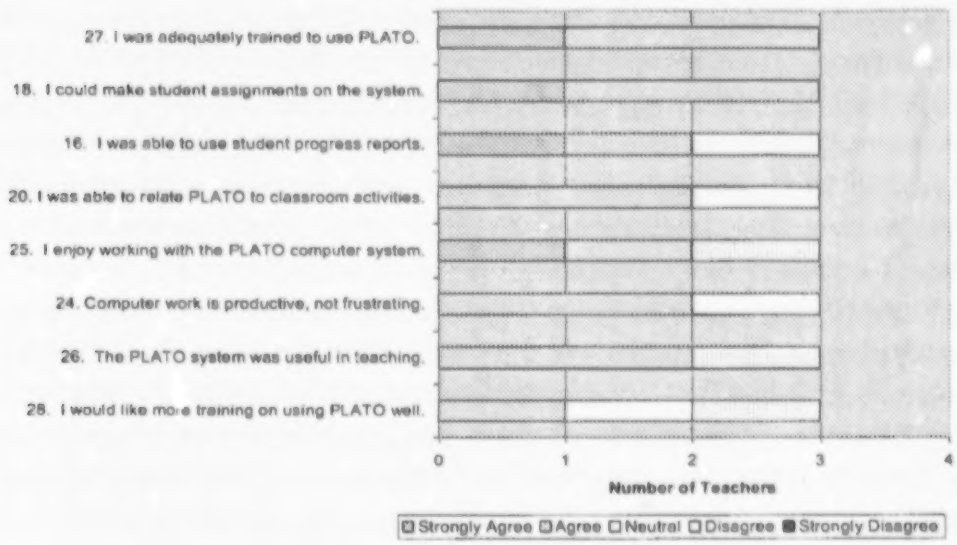
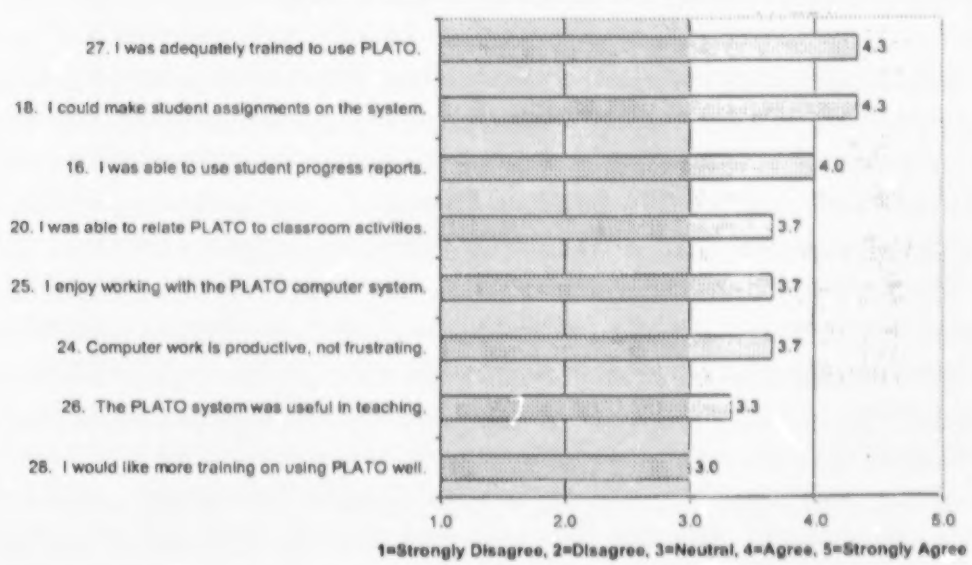

27. I was adequately trained to use PLATO.
18. I could make student assignments on the system.
16. I was able to use student progress reports.
20. I was able to relate PLATO to classroom activities.
25. I enjoy working with the PLATO computer system.
24. Computer work is productive, not frustrating.
26. The PLATO system was useful in teaching.
28. I would like more training on using PLATO well.
0
1
2
3
4
Number of Teachers
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree

Figure 12. Teacher Experience Mean Ratings


27. I was adequately trained to use PLATO.
4.3
18. I could make student assignments on the system.
4.3
16. I was able to use student progress reports.
4.0
20. I was able to relate PLATO to classroom activities.
3.7
25. I enjoy working with the PLATO computer system.
3.7
24. Computer work is productive, not frustrating.
3.7
26. The PLATO system was useful in teaching.
3.3
28. I would like more training on using PLATO well.
3.0
1.0
2.0
3.0
4.0
5.0
1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

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Student Experience with PLATO. All of the teachers agreed that students had enough time to work on PLATO. Two of the teachers agreed that they could do tutoring while students used PLATO and that students are *seldom* confused or trapped when using PLATO. One teacher strongly disagreed to this last question.

Figure 13. Student Experience with PLATO

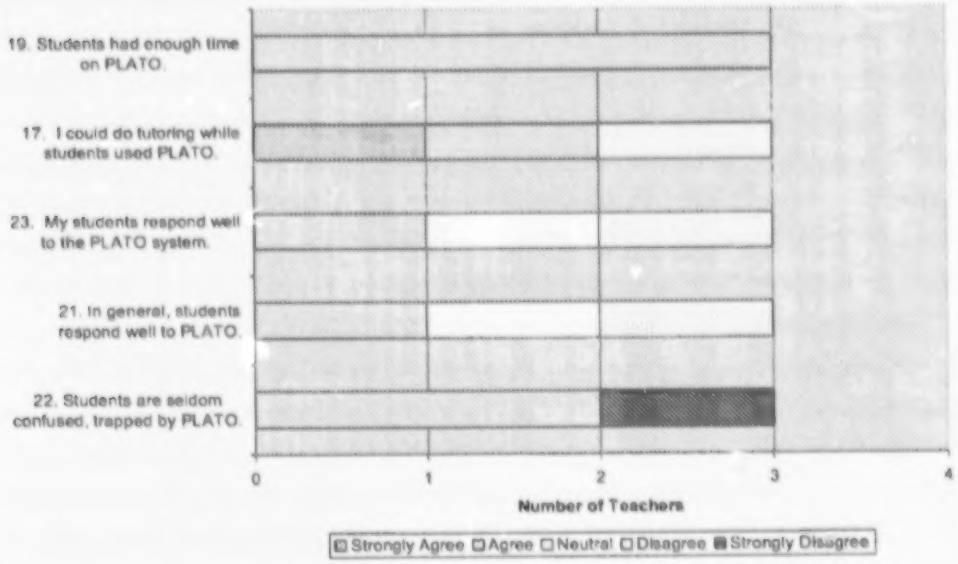
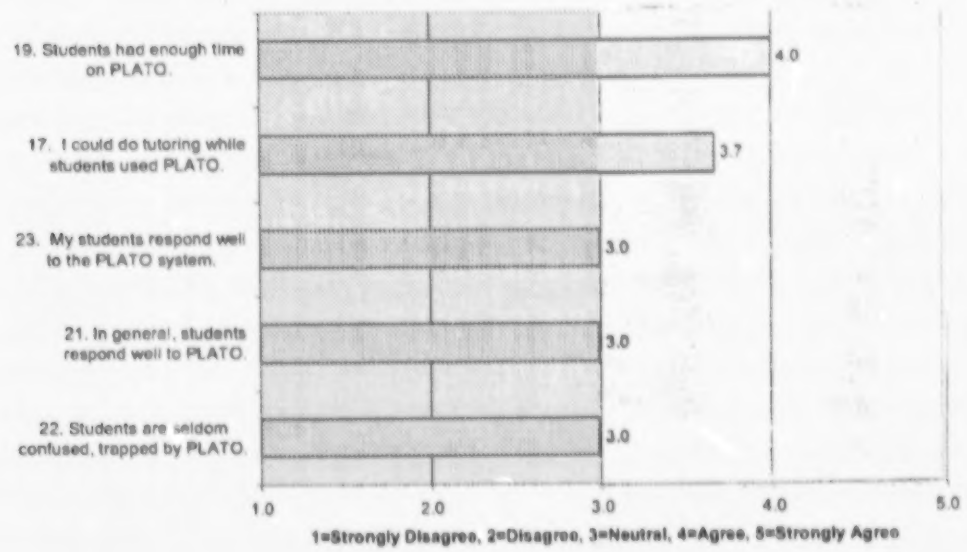


Figure 14. Student Experience Mean Ratings



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Frequency of Activities. The Instructor's PLATO Evaluation asked for ratings of how frequently teachers explained six issues to their students. Teachers discussed the following issues during most uses of PLATO: prerequisites for success with PLATO; procedures for getting help on PLATO; and how PLATO fits into course goals. The other issues were discussed less often.

Figure 15. Frequency of PLATO Activities

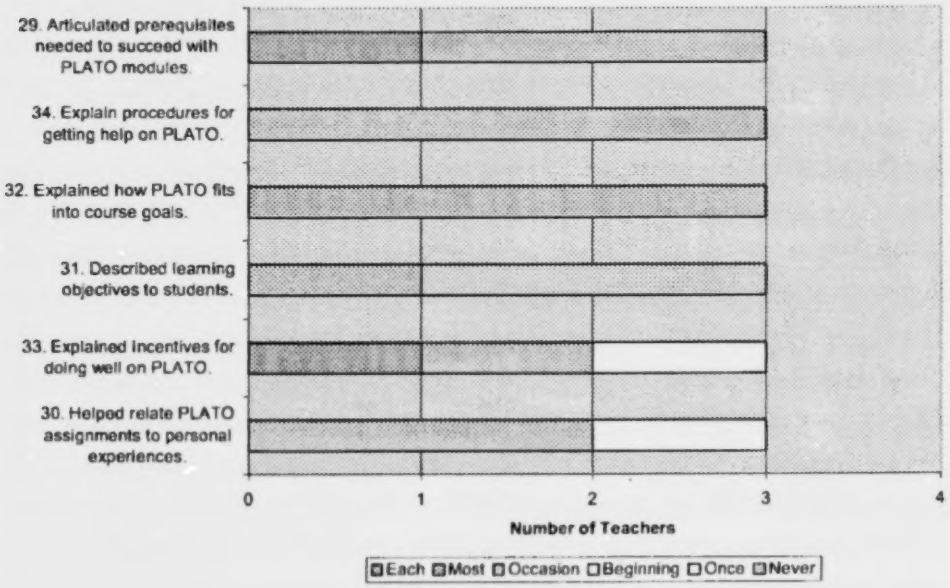
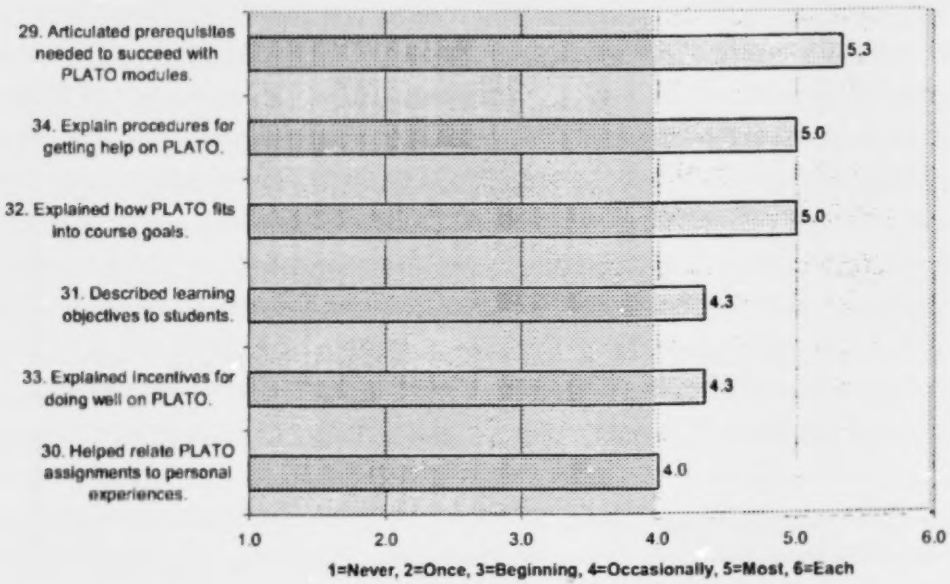


Figure 16. Mean of PLATO Activities



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Conclusions & Discussion

Conclusions will be presented and discussed in the general order that information was presented in the program description and data analysis section.

For the program description, the site coordinator, teacher, and student responses (while incomplete) did reveal some strengths and needs in the Highland Park PLATO selection and implementation.

- The Superintendent brought a new perspective about learning software when he joined the district, based upon, no doubt, reliable evidence. He also demonstrated commitment and purpose. However, it seems that administrators and teachers may not have been fully involved in the process of acquiring PLATO and, hence, were not energized about its adoption.

- Configurations of computers in labs or classrooms, with the attendant availability of computer time, may pose difficulties for some teachers. District requirements for two hours plus per week on PLATO may not be appreciated, especially by teachers who have not been able to use it powerfully and therefore feel it was not worth their time.

- While this sample was satisfied with their PLATO training, there is some indication that they could benefit from instruction in integrating PLATO and classroom education goals, assigning students appropriately, and making use of the acceleration possibilities of PLATO. Teacher turnover also necessitates ongoing training for technical skills as well as excellent instructional application.

- Teachers seem to be using PLATO as supplementary to classroom instruction, either because of their lack of coordination with classroom objectives, student use problems, or software issues.

- A good look at PLATO use from the students' point of view could improve implementation. Responses hint that some students feel they are not rewarded, either intrinsically or extrinsically, for their PLATO experience. Teachers mention using more "sticks" than "carrots" with their students.

PLATO use and test score analysis was strengthened by the large number of students for whom data was provided. At this time, the data exists only as a total set, without breakdowns for school or grade level. Below are the major findings resulting from the analysis.

- PLATO was used much more in the 1998-1999 school year than in 1999-2000. Nevertheless, student achievement scores were relatively stable.

- Scale scores were higher than the state average for math, average for reading, and below average for writing.

- Increases in the number of PLATO modules mastered are related to increases in higher test scores.

- Increases in the number of hours spent on PLATO are related to decreases in test scores. This suggests that slow progress in mastering modules on PLATO is an indicator of learning problems that the teacher should note and address.

- PLATO use data were modestly capable of predicting TLI scores in math, reading, and writing. Math regressions predicted 11 percent of the variance in TLI math scores. Reading regressions accounted for 6 percent of the variability in reading test scores. Writing regressions accounted for 21 percent of variance in the writing test scores.

About the Authors

David W. Quinn is currently working as an independent evaluator specializing in evaluating technology use for learning and teaching. He received a doctorate in educational evaluation from Western Michigan University in 1978. He recently completed ten years at the North Central Regional Educational Laboratory as a Senior Program Associate where he managed the evaluation unit and evaluated technology use in many setting. He has evaluated technology use for the states of Indiana and Virginia, and for school districts in Chicago, Miami-Dade, and Los Angeles County. Before NCREL, Dr. Quinn had conducted numerous evaluation studies for clients in K-12, university, not-for-profit social services, and for-profit training companies. For ten years he was on the faculty in the Department of Instructional Science, Brigham Young University, where he taught graduate research methods courses. He is the author of journal articles and book chapters evaluating technology use in education.

Nancy W. Quinn is an evaluator and instructional designer. She received a master's in Instructional Technology from Brigham Young University in 1991. She recently completed studies of statewide beginning literacy programs in three Midwestern states. She has evaluated the use of technology as a research tool in a research library. She has also evaluated the use of technology by fourth, fifth, and sixth graders in four-year at-school and at-home program.